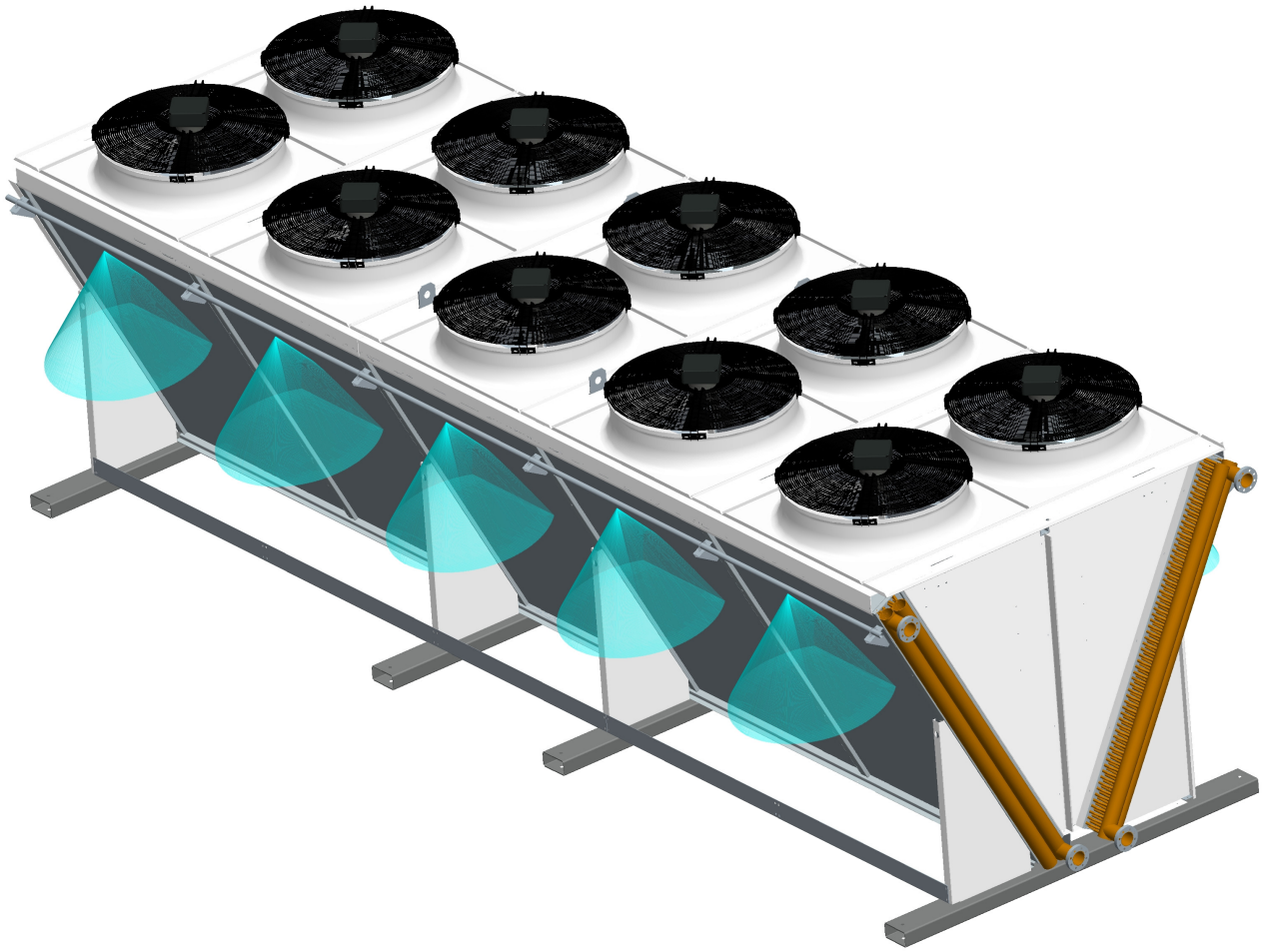
SPRAY WATER DEVICE

Alfagreen Vtype - Alfagreen Dual - AlfaBlue Dual



User Manual

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How to contact Alfa Laval
The contact information for each country is constantly updated in our website. Visit Alfalaval site to get this information.

THE TECHNICAL INFORMATION SUPPLIED AND OTHER MINOR CHANGES CAN BE MODIFIED WITHOUT NOTIFICATION.

TO THE USER

Dear User,

this instruction manual is intended to be your permanent guide for the different situations you may encounter when using this equipment.

Alfa Laval recommends you to study it carefully, and mainly, to make it available for the personnel who normally install, operate and maintain the equipment.
This manual will be useless if cannot be reached by the personnel who may need it.

In the unlikely case that you may have some problem not contemplated in this manual, don't hesitate to contact the closest Alfa Laval's representative.
We can offer you our help wherever you may be located.

NOTE

The manufacturer will not be held liable in any way and the product warranty no longer is valid if these instructions are not observed or the units are not used correctly.

System Warranty:

This equipment is designed to operate properly when installed in accordance with accepted industry standards. Failure to meet the following conditions may result in voiding the system warranty:

- Water circuit, valves or accessories must be installed following industry standards for good piping practices.
- Set fluid flow and pressure of water circuit in accordance with what is described in this manual.
- Do not set the device to work over 12 bar.
- Use only water treated as described in this manual.
- Don't use this kit for more than 400 hours per year.
- Don't walk on pipes or supports.
- Factory installed layout must not be changed without written Alfa Laval's approval.

ATTENTION!

The connections require qualified installers to complete the liquids circuits.
Do not perform any installation or maintenance operations without having disconnected the power supply.

GENERAL

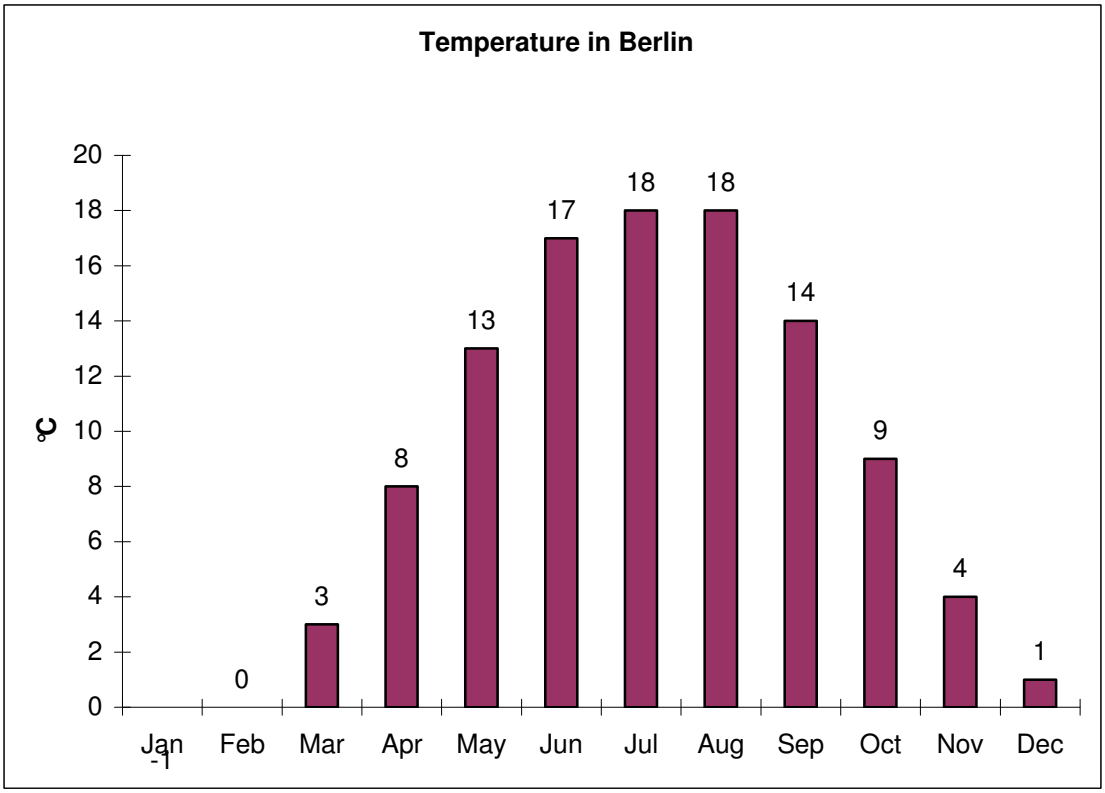
It consists of a pipe system with several fitted spraying nozzles that nebulize water in the air suction of the coil.
The spray water solution is used to increase the cooling capacity of the units, by humidification of air around the coil.
The adiabatic cooling device consists of a pipe system mounted on the air suction side.
From the spraying nozzles the water is sprayed into the inlet air, saturated inlet air causes a significant increase of cooling capacity.
The inlet temperature could sink by adiabatic cooling of 5-6 °C. This data strictly depends on ambient temperature, air velocity, airflow and relative humidity.

APPLICATIONS

Alfa Laval suggests applying adiabatic cooling device, on dry coolers and condensers, when there is a reasonable difference between dry bulb and wet bulb temperatures.

The following benefits can be achieved installing Spray Water Device:

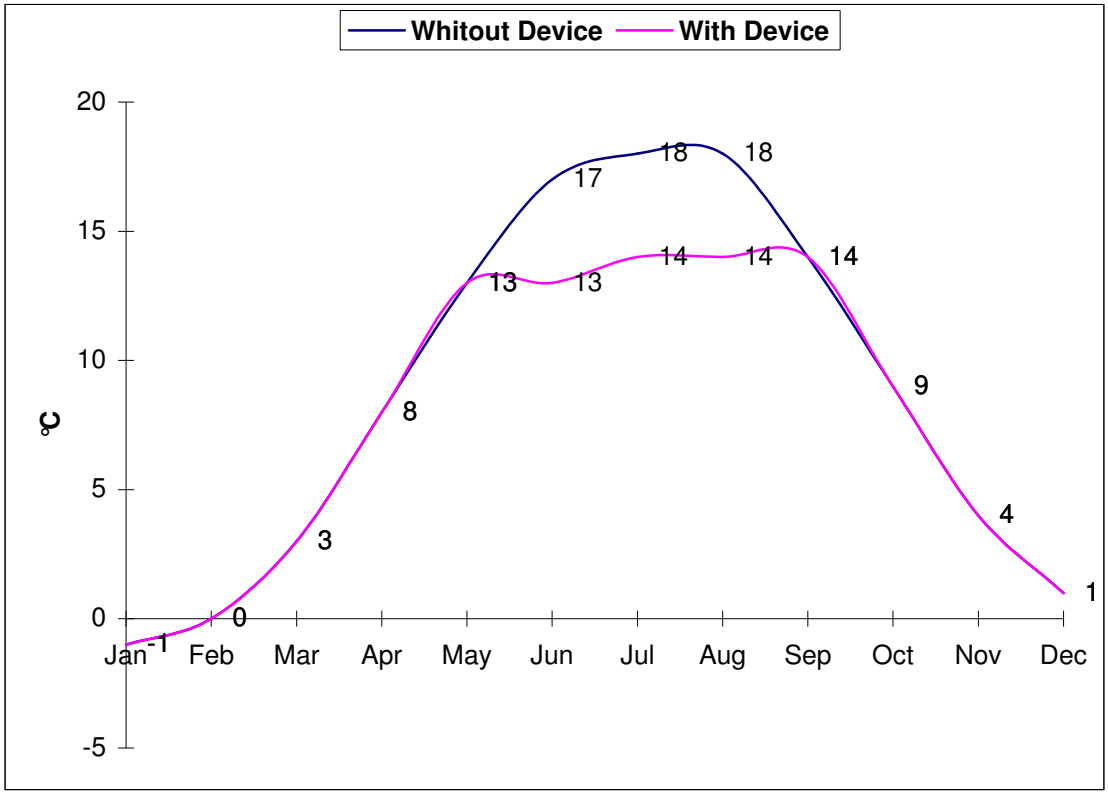
- It is possible to overcome the heat peak.
- It is possible to use the unit to cool water at temperatures lower than the ambient air temperature.
- Dry-Coolers and Condensers can be designed for a much lower entering air temperature to obtain a smaller dimension unit with a smaller heat exchanger surface.



Take Berlin as example: the average temperature in the city last year was 8.6°C.
July and August were the hottest months, as showed in the graph during these months the temperature was 18°C.

If we don't consider July and August in our statistic, the average temperature decreased to 6.8°C.

Without Spray Water Device we have to select a condenser or dry cooler able to work also during the hottest days of the year: 18°C during the day.
Anyhow, knowing that these days represent 4% of all year, we have to oversize the unit.



If we consider a new unit with Spray Water Device, it's possible to select a unit to work at 14°C.
Spray Water Device will help to overcome the heat peak during July and August.

The average temperature during the year without these months is 6.8°C.

In Berlin we suggest to use the device during July and August for a total amount of 360 hours per year, considering that it's not necessary use the device during the night because the temperature decrease.

TRANSPORT AND STORAGE

Kit Spray Water is delivered mounted for Alfagreen Vtype and AlfaBlue models.

If the equipment has to be stored before its installation (one or more months) it is convenient to take the following precautions:

- Leave the equipment in its packing.
- Store it indoors, in a room with adequate conditions: temperature (15 to 25 º C), humidity (50 to 70 %) and environment without corrosive liquids or vapors.

ATTENTION!

The condition of the unit should be verified at the moment of reception, check for shock marks or cracks, which could cause damage to the equipment.
In case of damages during transportation, the transportation company should be informed immediately, in writing in the Document of Delivery.

"It means that if the receiver accepts the goods (stamps and signs the document) without any note of non-conformity, the forwarder is not responsible for missing packages or damaged goods.

We strongly recommend the customer to evidence damaged or missing goods on the full set of this document at the arrival of the goods.

With a copy of it by e-mail in your hands, we can speed up corrective actions towards the forwarder and ask for insurance reimbursement.

Be careful, we can act only if we sell in DDU or DDP final destination basis, i.e. our recommended delivery terms.

For ex-works shipments the customer has to act directly with forwarder in charged by himself as per INCOTERMS2000 rules."

Then, Alfa Laval or one of its agents should be informed regarding the damage on the equipment.
The Client should complete a written report including photographs concerning each relevant damage.

LAYOUT

Follow the instructions of unit installation manual and remember that**:**

Not all the water sprayed will evaporate; therefore any surplus water must be drained or recovered. Alfa Laval doesn't provide a drain pan because the layout could change depending on customer installation.

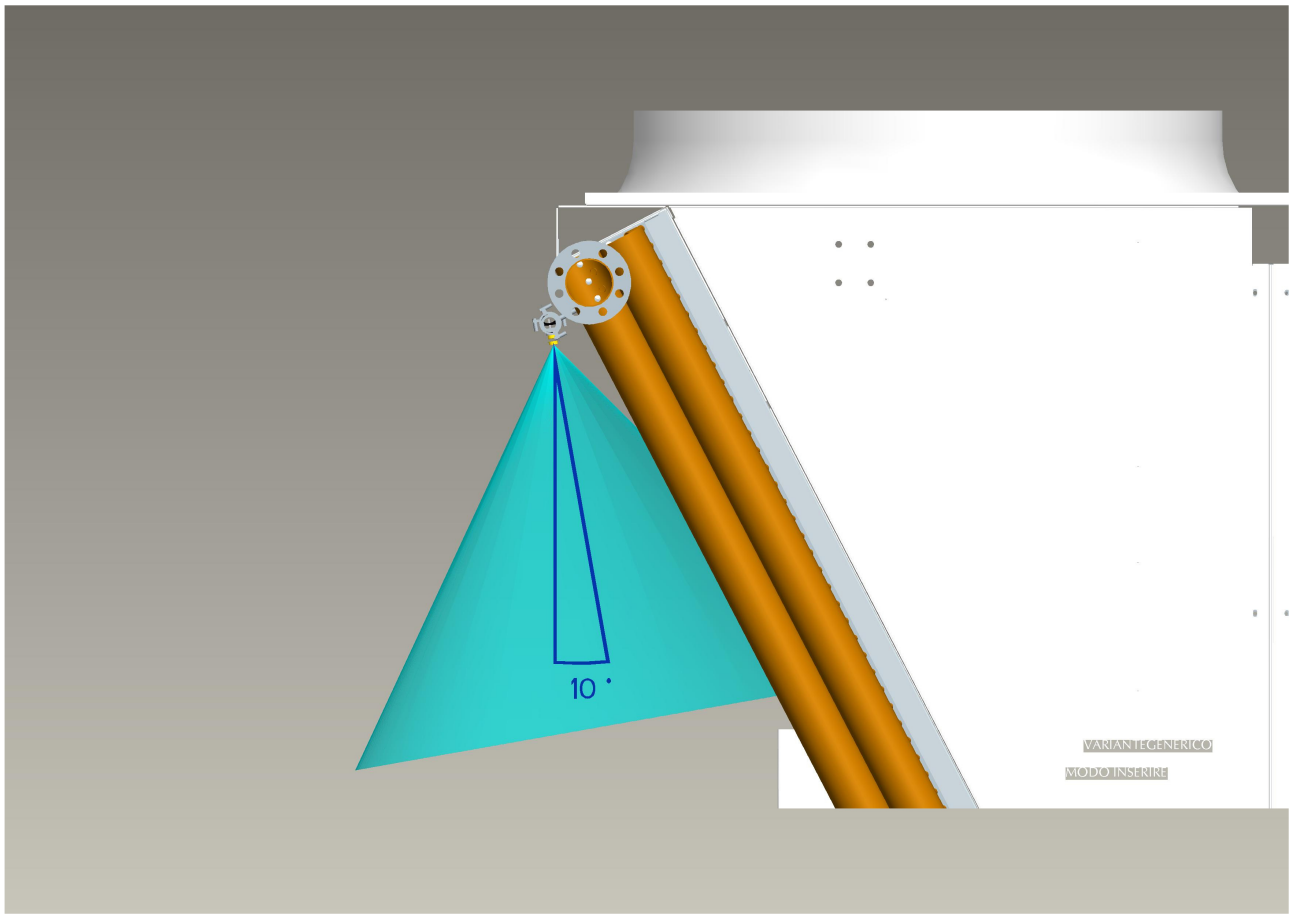
- Leave the space to connect the kit to the main pipeline.
- Do not install the kit where there is wind, as reported on unit instruction manual.

ATTENTION!

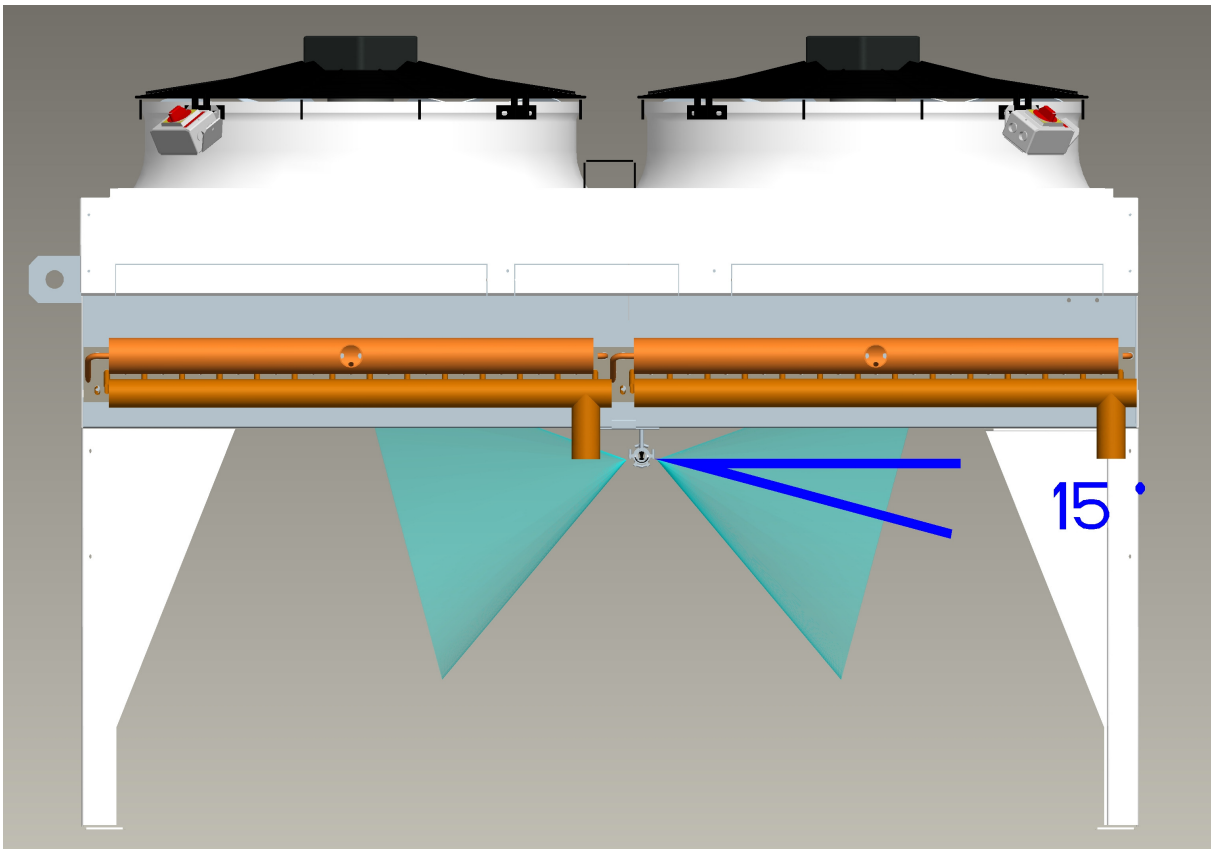
This device has been developed to avoid the risk of *Legionella.*
If you want to provide a tray to recover not evaporated water remember to:

DO NOT promote water accumulation to avoid the growth and spread of *Legionella.*

On V-type the nozzle angle is set on 10 degrees on vertical (drawing below).
This angle assures the best performance in absence of wind and humidity-temperature average conditions.



On Dual the nozzle angle is set on 15 degrees on horizontal (drawing below).
This angle assures the best performance in absence of wind and humidity-temperature average conditions; both in vertical and horizontal unit installation.



NOTE
Before installing and starting up the Spray Water Device read this paragraph carefully.

Spray Water Device efficiency is influenced by:

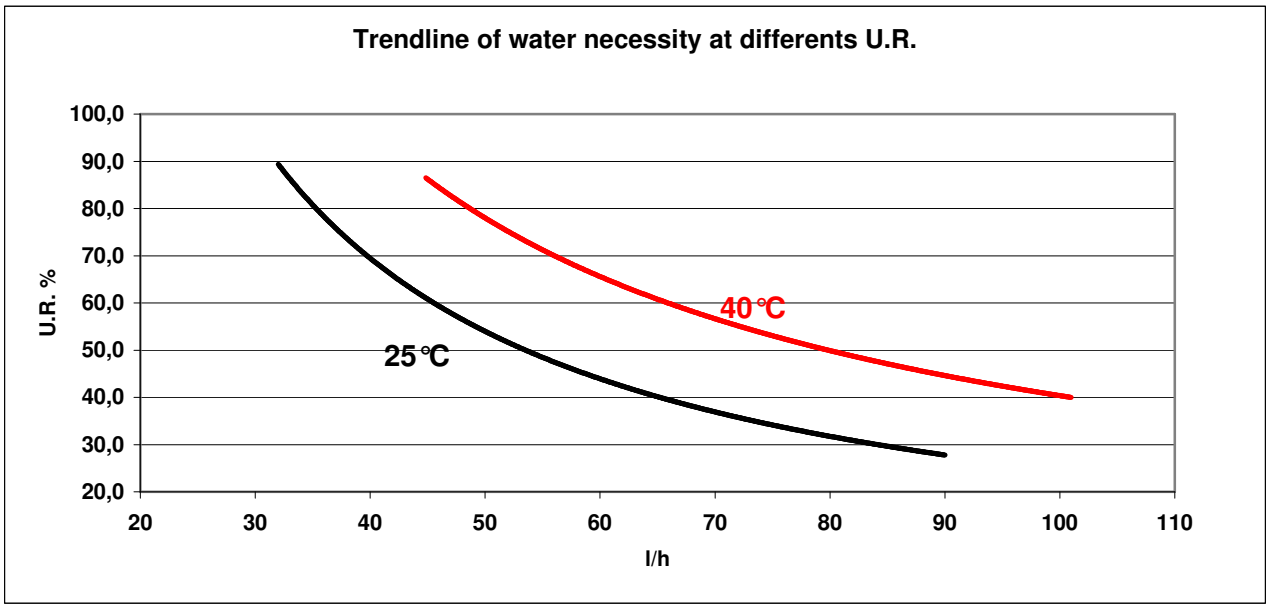
- Relative humidity
- Ambient temperature
- Fans motor airflow
- Wind

The correlation between **relative humidity** and water absorption degree of efficiency is not linear.
For example:

If relative humidity is 90% the air is almost saturated; using Spray Water Device an abnormal dipping will be noted. It's because the air is not able to accept additional water inside. It's not necessary using the device.

If relative humidity is 30% the device is absolutely necessary, the charge of water in the air has to be increased; the air will well accept nebulized water because it's far from saturation point.

If the **ambient temperature** increases, also the water needed to saturate the air will increase. Take a look to psychromeytric chart on chapter “theory” to better understand.



For example, over a graph obtained by experimental test, which show the correlation between relative humidity, temperature and water necessity for humidification, as described above.

The **fan motor airflow** is necessary to:

Intake the saturate air into the coil.
Increase nebulization efficiency thanks to turbulence created.

If the fan motor rpm decrease the device efficiency will decrease too.

In presence of light **wind** there are two opposite effects to evaluate:

Wind favourite air circulation increasing unit performance, this is positive.
Unfortunately light wind perturb droplet trajectory, also creating dipping; this is negative.

NOTE

Heavy wind is always negative, check unit installation manual to deeply understand reasons and solutions.
Anyhow, Spray Water Device will not function in the correct way in presence of heavy wind.

THEORY

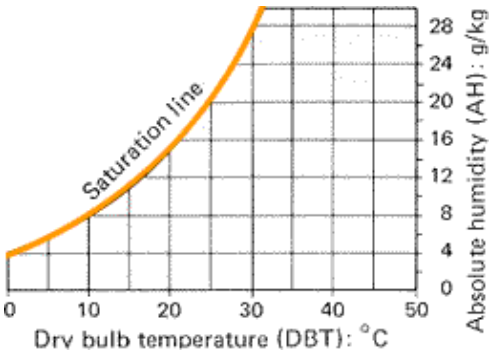
The adiabatic saturation temperature is a specific temperature value at which water by adiabatic evaporating brings the air itself to a saturation point; this then cools the water turning the temperature towards the wet bulb temperature.
The physical phenomenon of adiabatic saturation is obtained by using an adiabatic vaporizing system. The suction air on the water cooler collides with a very fine water particle mist obtained with custom built spray nozzles fitted in order to create a complete and uniform saturation of the entering air.
For these reasons nozzles are not oriented on coil, scope of Spray Water Device is humidifies the air around the coil.

The psychometric chart

To explain how to calculate the adiabatic saturation temperature it's necessary to introduce the psychometric chart.
The psychometric chart represents the state of a given atmosphere by a point, which gives the dry-bulb, wet-bulb, relative humidity, specific volume and saturation temperature of the atmosphere.

Saturation humidity line:

Absolute humidity (AH) is the vapor content of air, given in grams of water vapour per kg of air, i.e. g/kg. Air at a given temperature and pressure can support only a certain amount of moisture and no more. This is referred to as the **saturation humidity** (SH). If this is plotted on a graph against the dry bulb (air) temperature (DBT), we have the basis of the psychromeytric chart and we get what is called the saturation humidity line.

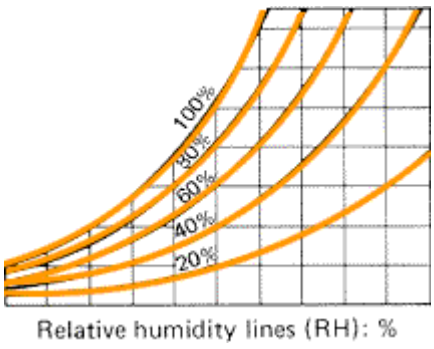


Relative humidity line:

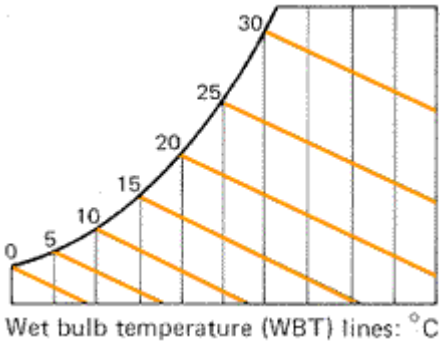
Relative humidity (RH) is an expression of the moisture content of a given atmosphere as a percentage of the saturation humidity at the same temperature:

RH = 100 x AH/SH (%)

Relative humidity lines are plotted on the psychrometric chart by halving each SH ordinate to obtain the 50% curve, and further proportionate subdivision gives any intermediated RH curve.

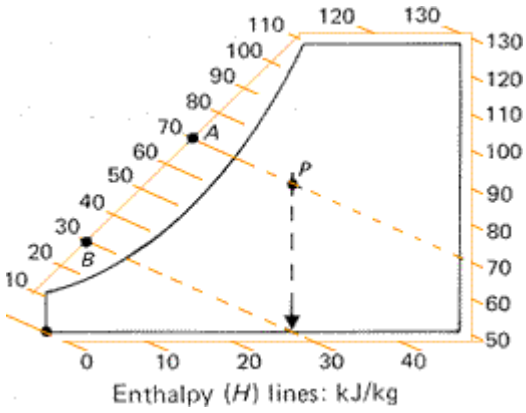


Wet bulb temperature lines:



Wet bulb temperature (WBT) is measured by a hygrometer (or psychrometer). This consists of two thermometers, one measuring the DBT, the other having its bulb enclosed in a wet wick. 'Web bulb depression' is noted as the difference in the temperatures between the wet wick thermometer and the DBT. The difference happens as the wet wick thermometer is cooled down by the evaporation on the wick.
The amount of evaporation is a direct indication of the moisture carrying capacity of the atmospheric air at that temperature and that lowers the WBT. When the air is saturated, there is no evaporation, thus the DBT and WBT readings are identical, and the depression is zero. In this way, the 'status point' is determined at the intersection of the vertical DBT line and the sloping WBT line of the psychrometric chart.

Enthalpy lines:

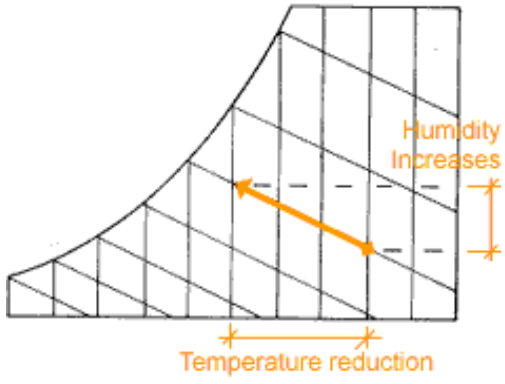


Enthalpy (E) is the heat content of unit mass of the atmosphere, in kJ/kg, relative to the heat content of 0°C dry air. It was omitted from the psychromteric chart shown above to avoid confusion which a third set of lines will cause. The enthalpy lines would almost, but not quite, coincides with the WBT lines. To avoid the confusion in representing it, the enthalpy scale is given at the perimeter of the chart and can be read by using a straight edge.
For air condition P the enthalpy is read at point A.
The sensible heat component can be read at point B, corresponding to the enthalpy of dry air at the same temperature. The remainder, i.e., A - B, is the latent heat content.

The psychometric processes

A point on the chart, known as the status point, represents the state of a given atmosphere**.** If any two of the three commonly available characteristics DBT, WBT and RH are known, the others can be read from the chart.
Adiabatic saturation, can be represented by the movement of this status point in the following ways:

Adiabatic saturation:



If moisture is evaporated into an air volume without any heat input or removal (this is the meaning of the term *'adiabatic'*), the latent heat of evaporation is taken from the atmosphere. The sensible heat content - thus the DBT - is reduced, but the latent heat content is increased. The status point moves up and to the left, along a WBT line. This is the process involved in evaporative cooling.

FUNCTIONALITY RANGE

Spray Water Device has been designed to properly work on various sets of external temperature and relative humidity:

T air °C	Relative Humidity %
25 ÷ 40	30 ÷ 60

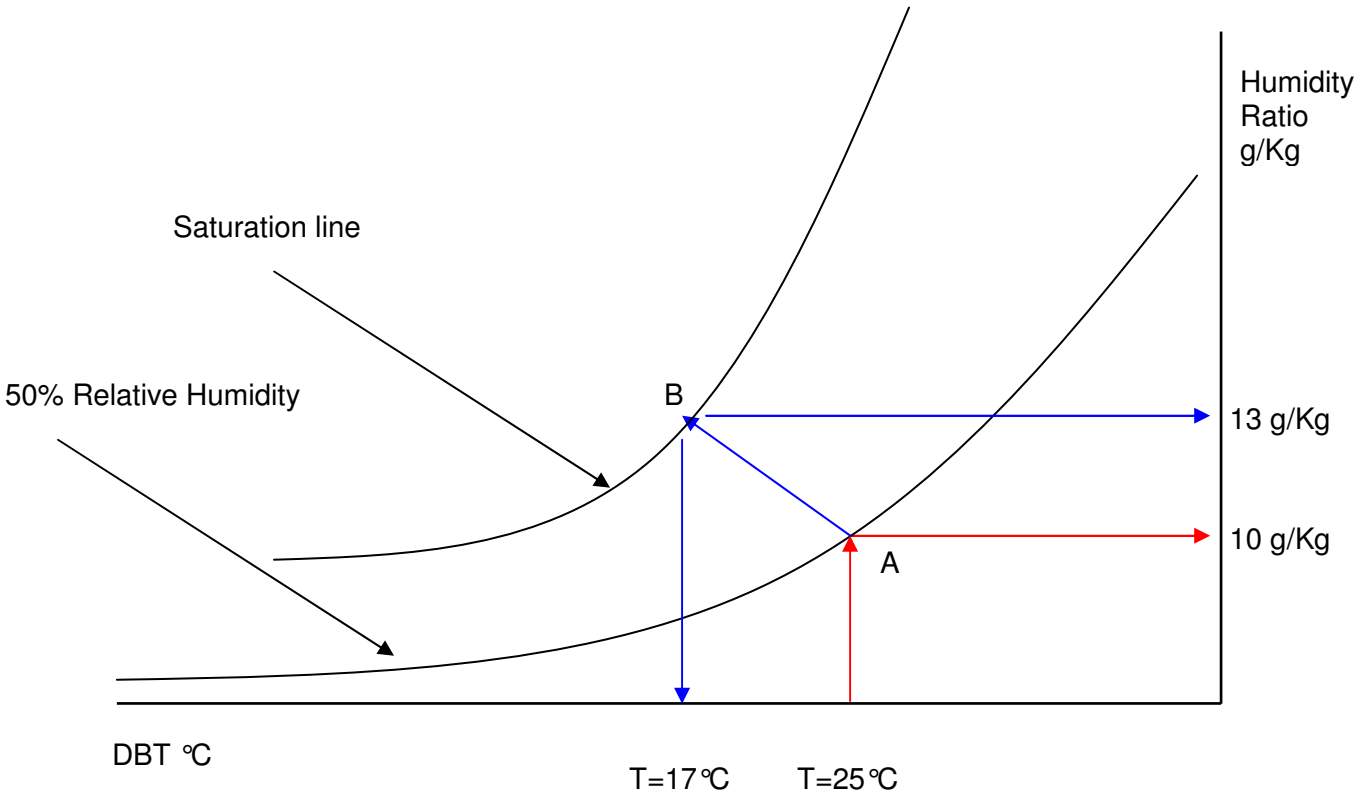
NOTE

If the unit has to work outside of this range, please contact Alfa Laval Heat Air Exchanger Product Center to obtain an accurate Device design.

Example of theoretical calculation

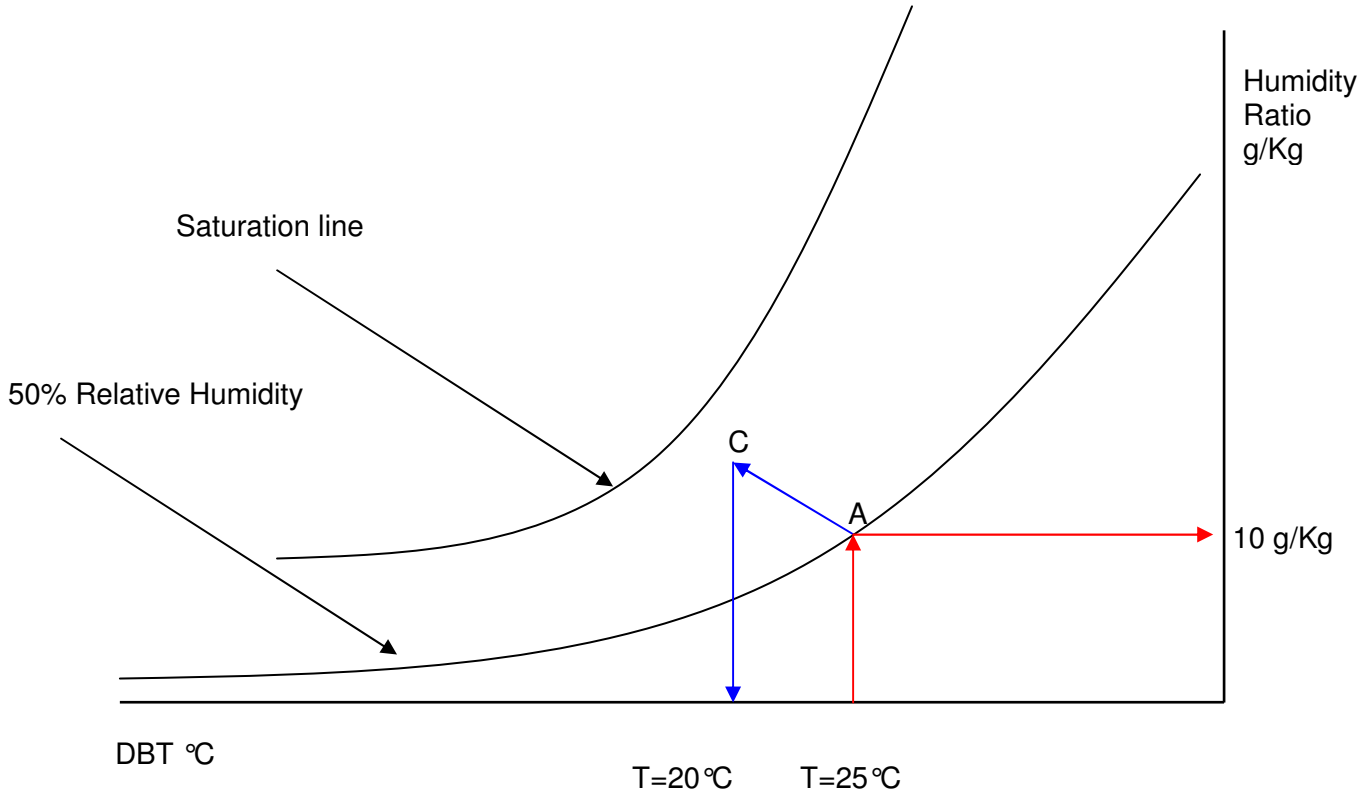
Suppose that T ambient (external air) is 25°C / 50 % Ur (Point A).

The corresponding humidity ratio is 10 g/Kg of dry air.
From the point A, following the corresponding line at constant enthalpy, on saturation line we set Point B; the corresponding humidity ratio is 13 g/Kg of dry air.



The air after the treatment should be at 17°C, but the humidification efficiency never is 100%.

The humidification efficiency must be considered of 70%.
For this the length of line AC is the 70% of line AB: AC = 0.7*AB



Finally the inlet temperature before coil is 20°C.

To find the water flow follows the example:

ΔX= (13-10)= 3 g/kg dry air

The airflow rate can be found with Palladio, suppose a total amount of 1000 m^3/h.

M=1000m^3/h x 1.2 kg/m^3=1200 kg/h

The necessary amount of water to humidify the air is:

Mw = M x ΔX = 1200 kg/h x 3 g/kg = 3600 g/h = 3.6 l/hour

Every hour you must nebulize on the air 3.6 l of water to obtain an efficiency of 80%.

NOTE

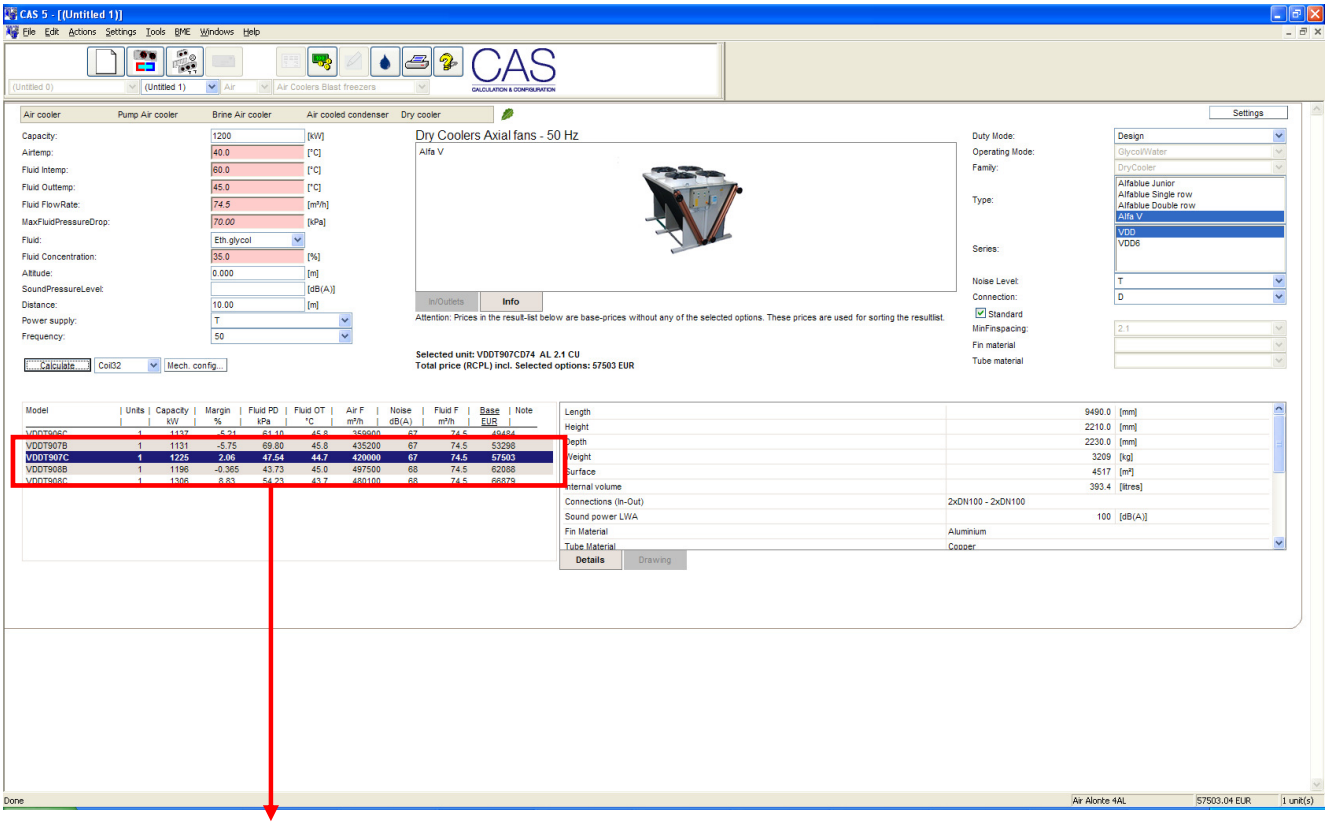
Calculation based on psychometric chart is affected from a huge number of environment variables, for this reasons Spray Water Device should be set considering surrounding conditions.

USE CAS CONSIDERING SPRAY WATER DEVICE

Suppose the air conditions:

Temperature= 40℃
Relative Humidity= 60%

If you need 1200kW to cool a fluid (Ethylen Glycol 35%) from 60℃ to 45℃, you should select in this way:

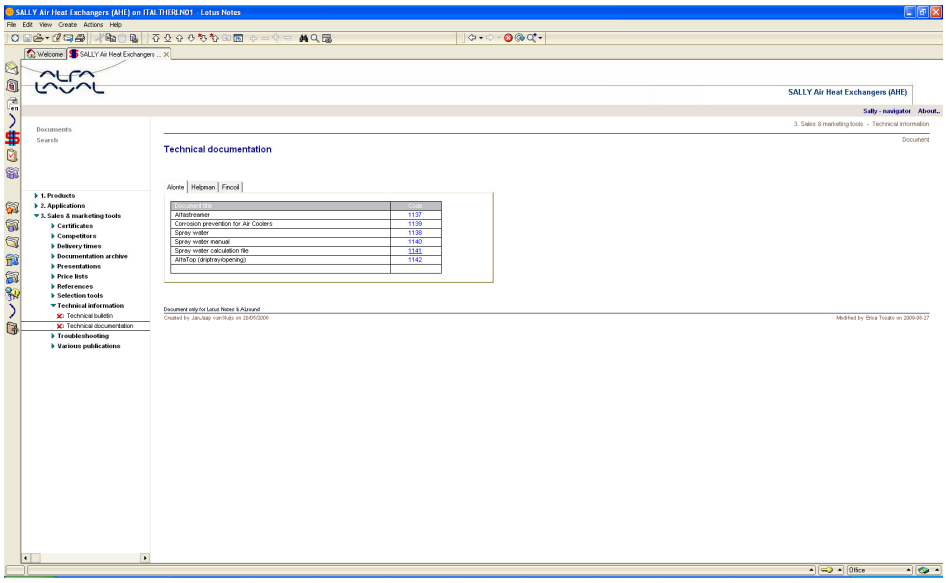


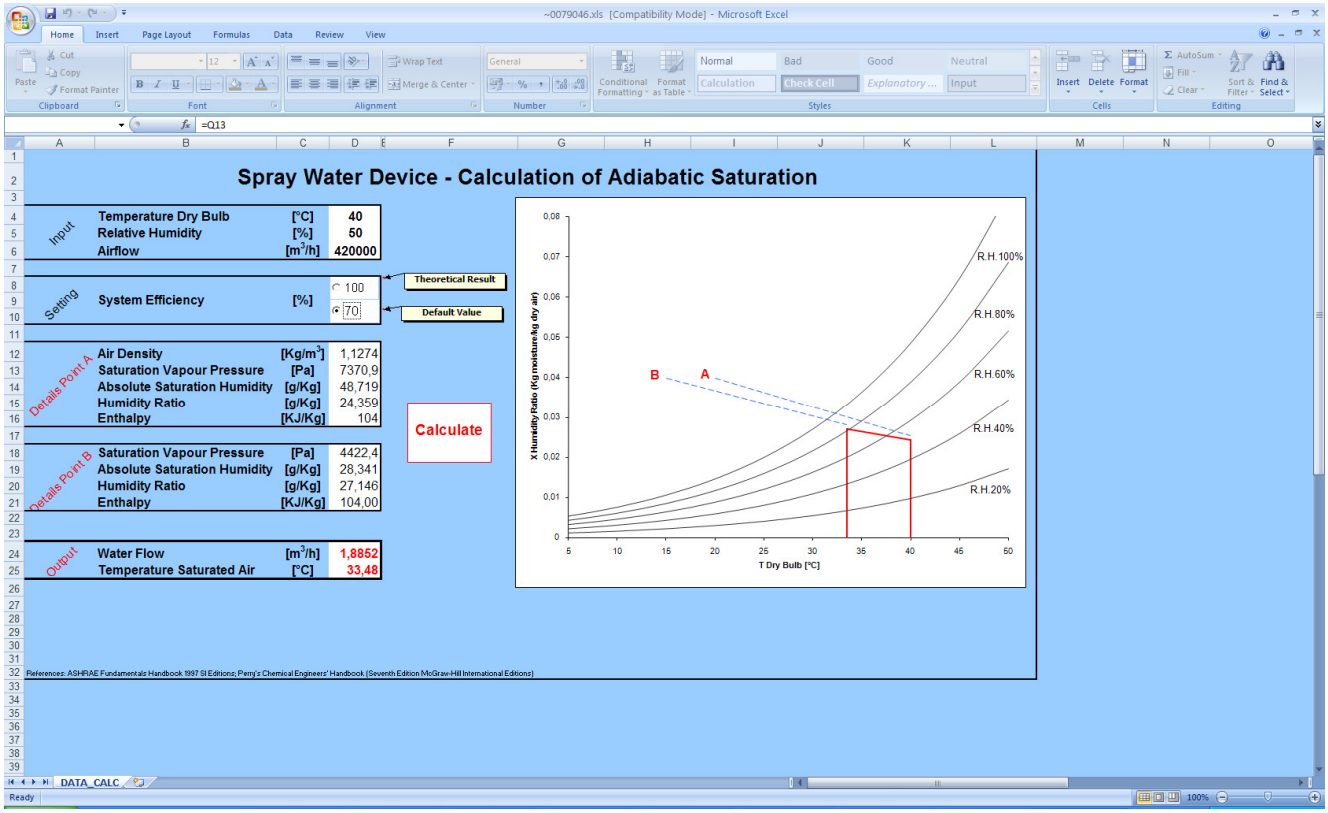
Model	**1 x VDDT907C**	
Required Capacity	**1200.00**	**kW**
Margin	2.1	**%**
Length	9490	mm
Height	2210	mm
Depth	2230	mm
Standard Unit Weight	3209	kg
Fan data (per single model)		
Air Flow Rate: High	420000	m3/h
Number of Fans	14	-
Fan Diameter	910	mm
Rotation Speed	890	1/min
Noise LWA/LPA (10,0 m)	100 / 67	dB(A)
Power Consumption Op/Nom	50400	W
Voltage	400(D)	V
Nominal current	100.8	A

Considering that the air reach 40°C only during the summer, using a Spray Water Device you can select a unit smaller and cheaper.

In the next chapter there are some table which indicate how choice the device; below it's perform an example.

Using the Spray Water Calculation File present in Sally (see picture), at 40°C and 50% of relative humidity (point A), the corresponding humidity ratio is 24,359 g/Kg of dry air.





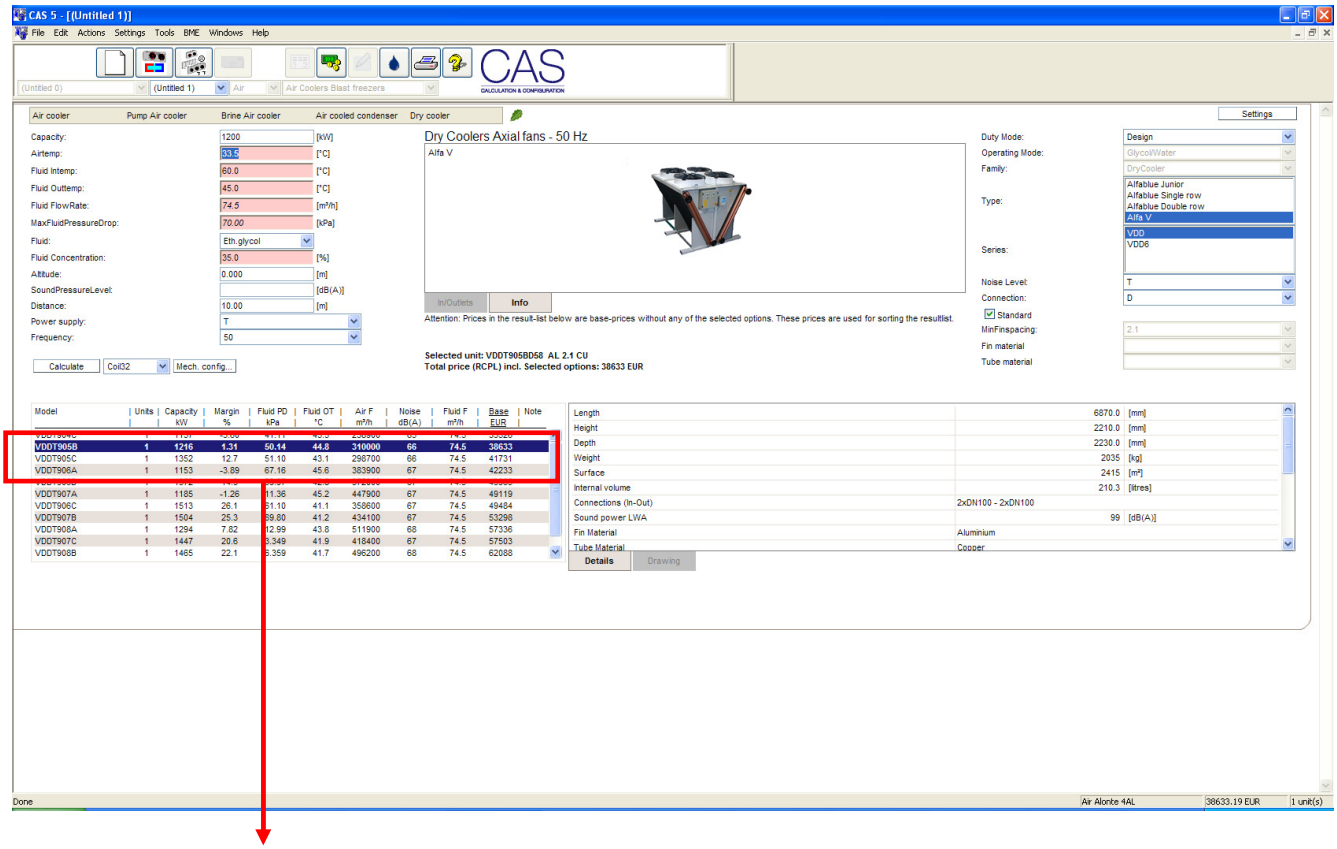
From the point A, following the corresponding line at constant enthalpy, on saturation line we set point B; the corresponding humidity ratio is 27,146 g/Kg of dry air.

The humidification efficiency must be considered of 70%.
For this the final temperature inlet temperature before coil is 33,48°C, it has been rescue 6.5°C.

The new air conditions are:

Temperature= 40-6.5°C = 33.5°C
Relative Humidity ~ 100%

Selecting the unit with the new condition you need obtain:



Model	**1 x VDDT905B**	
Required Capacity	**1200,00**	**kW**
Margin	**1.3**	**%**
Length	6870	mm
Height	2210	mm
Depth	2230	mm
Standard Unit Weight	2035	kg
Fan data (per single model)		
Air Flow Rate: High	310000	m3/h
Number of Fans	10	-
Fan Diameter	910	mm
Rotation Speed	890	1/min
Noise LWA/LPA (10,0 m)	99 / 66	dB(A)
Power Consumption Op/Nom	36000	W
Voltage	400(D)	V
Nominal current (*)	72	A

Relevant difference between the units selected:

	Without Spray Water Device	**With Spray Water Device**
Model	**1 x VDDT907C**	**1 x VDDT905B**
Length	9490 mm	6870 mm
Standard Unit Weight	3209 Kg	2035 Kg
Number of Fans	14	10
Power Consumption Op/Nom	50400 W	36000 W
Nominal current	100.8 A	72.0 A

To evaluate by yourself water flow rate necessary in this condition are necessary:

- Humidity ratio of point A: 24,359 g/Kg (using the calculation file).
- Humidity ratio of point B: 27,146 g/Kg (using the calculation file).
- The airflow rate of the second unit selected: 310000 m³/h (on CAS printout).
- Air density at 40°C and 50% Relative Humidity: 1,1274 Kg/ m³ (from the calculation file)

The necessary amount of water to humidify the air is:

Mw = 1,8852 [m3/h].

NOTE

In case of particular surrounding conditions and low fan rotations speed, the air pressure drop on coil could increase due to fine drops accumulation.
Alfa Laval strictly recommend to select and use an adequate fin spacing.

STANDARD WORKING PRESSURE AND FLOW CONDITIONS

Alfa Laval provides three types of nozzle, as sum up below.

Model with electrical wiring D	Nozzle type I	Nozzle type II	Nozzle type III
VDDS / VDD6 / ACVS 800-910	X		
VDDS / VDD6 / ACVL 800-910	X		
VDDS / VDD6 / ACVQ 800-910-1000		X	
VDDS / VDD6 / ACVR 800-910-1000		X	
BCDT / BCDS / BDDT / BDDS / BNDT / BNDS 800-910		X	
BCDL / BDDL / BNDL 800-910		X	
BCDQ / BDDQ / BNDQ 800-910-1000			X
BCDR / BDDR / BNDR 800-910-1000			X

Model with electrical wiring Y	Nozzle type II	Nozzle type III	Nozzle type III (**)
VDDS / VDD6 / ACVS 800-910	X		
VDDS / VDD6 / ACVL 800-910	X		
VDDS / VDD6 / ACVQ 800-910-1000		X	
VDDS / VDD6 / ACVR 800-910-1000		X	
BCDT / BCDS / BDDT / BDDS / BNDT / BNDS 800-910		X	
BCDL / BDDL / BNDL 800-910		X	
BCDQ / BDDQ / BNDQ 800-910-1000			X (**)
BCDR / BDDR / BNDR 800-910-1000			X (**)

(**) decrease the water flow pressure of 50%, according to the airflow rate.

The nozzle is coupled to a unit cosidering:

- Module surface.
- Average airflow rate.
- Unit layout.

The nozzle proposed, delivered as standard realize the best performance in standard condition.

Note

If the working conditions are out of standard it's possible to interchange the nozzle type mounted.

- **Vtype Standard noise and Vtype Low noise**

			Total Water Flow Inlet (l/min)	
Model	**Length (mm)**	**Number of nozzles**	**Electrical wiring D**	**Electrical wiring Y**
VDD S/T/L 802/902 VDD6 S/T/L 802/902 ACV S/T/L 802/902	2620	4	5.02	2.04
VDD S/T/L 803/903 VDD6 S/T/L 803/903 ACV S/T/L 803/903	3930	6	7.08	3.06
VDD S/T/L 804/904 VDD6 S/T/L 804/904 ACV S/T/L 804/904	5240	8	10.04	4.08
VDD S/T/L 805/905 VDD6 S/T/L 805/905 ACV S/T/L 805/905	6550	10	13	6
VDD S/T/L 806/906 VDD6 S/T/L 806/906 ACV S/T/L 806/906	7860	12	15.06	7.02
VDD S/T/L 807/907 VDD6 S/T/L 807/907 ACV S/T/L 807/907	9170	14	18.02	8.04
VDD S/T/L 808/908 VDD6 S/T/L 808/908 ACV S/T/L 808/908	10480	16	20.08	9.06

Electrical wiring D: Every nozzle is designed to work at 2.5bar and nebulize 1.3 l/min.
Electrical wiring Y: Every nozzle is designed to work at 2.5bar and nebulize 0.6 l/min.

- **Vtype Quiet noise and Vtype Residential noise**

Model	Length (mm)	Number of nozzles	Total Water Flow Inlet (l/min)	
			Electrical wiring D	Electrical wiring Y
VDD Q/R 802/902/1002 VDD6 Q/R802/902/1002 ACV Q/R 802/902	2620	4	2.04	1.02
VDD Q/R 803/903/1003 VDD6 Q/R803/903/1003 ACV Q/R 803/903	3930	6	3.06	1.08
VDD Q/R 804/904/1004 VDD6 Q/R804/904/1004 ACV Q/R 804/904	5240	8	4.08	2.04
VDD Q/R 805/905/1005 VDD6 Q/R805/905/1005 ACV Q/R 805/905	6550	10	6	3
VDD Q/R 806/906/1006 VDD6 Q/R 806/906/1006 ACV Q/R 806/906	7860	12	7.02	3.06
VDD Q/R 807/907/1007 VDD6 Q/R 807/907/1007 ACV Q/R 807/907	9170	14	8.04	4.02
VDD Q/R 808/908/1008 VDD6 Q/R 808/908/1008 ACV Q/R 808/908	10480	16	9.06	4.08

Electrical wiring D: Every nozzle is designed to work at 2.5bar and nebulize 0.6 l/min.
Electrical wiring Y: Every nozzle is designed to work at 2.5bar and nebulize 0.3 l/min.

- **Double Row Standard noise and Double Row Low noise**

Model	Length (mm)	Number of nozzles	Total Water Flow Inlet (l/min)	
			Electrical wiring D	Electrical wiring Y
BCDT / BCDS / BDDT / BDDS / BNDT / BNDS 802/902 BCDL / BDDL / BNDL 802/902	3500 4200	8	4.8	2.4
BCDT / BCDS / BDDT / BDDS / BNDT / BNDS 803/903 BCDL / BDDL / BNDL 803/903	5250 6300	12	7.2	3.6
BCDT / BCDS / BDDT / BDDS / BNDT / BNDS 804/904 BCDL / BDDL / BNDL 804/904	7000 8400	16	9.6	4.8
BCDT / BCDS / BDDT / BDDS / BNDT / BNDS 805/905 BCDL / BDDL / BNDL 805/905	8750 10500	20	12	6
BCDT / BCDS / BDDT / BDDS / BNDT / BNDS 806 BCDL / BDDL / BNDL 806	10500	24	14.4	7.2

Electrical wiring D: Every nozzle is designed to work at 2.5bar and nebulize 0.6 l/min.
Electrical wiring Y: Every nozzle is designed to work at 2.5bar and nebulize 0.3 l/min.

- **Double Row Quiet noise and Double Row Residential noise**

Model	Length (mm)	Number of nozzles	Total Water Flow Inlet (l/min)	
			Electrical wiring D	Electrical wiring Y
BCDQ / BDDQ / BNDQ 802/902/1002 BCDR / BDDR / BNDR 802/902/1002	3500 4200	8	2.4	1.2
BCDQ / BDDQ / BNDQ 803/903/1003 BCDR / BDDR / BNDR 803/903/1003	5250 6300	12	3.6	1.8
BCDQ / BDDQ / BNDQ 804/904/1004 BCDR / BDDR / BNDR 804/904/1004	7000 8400	16	4.8	2.4
BCDQ / BDDQ / BNDQ 805/905/1005 BCDR / BDDR / BNDR 805/905/1005	8750 10500	20	6	3
BCDQ / BDDQ / BNDQ 806 BCDR / BDDR / BNDR 806	10500	24	7.2	3.6

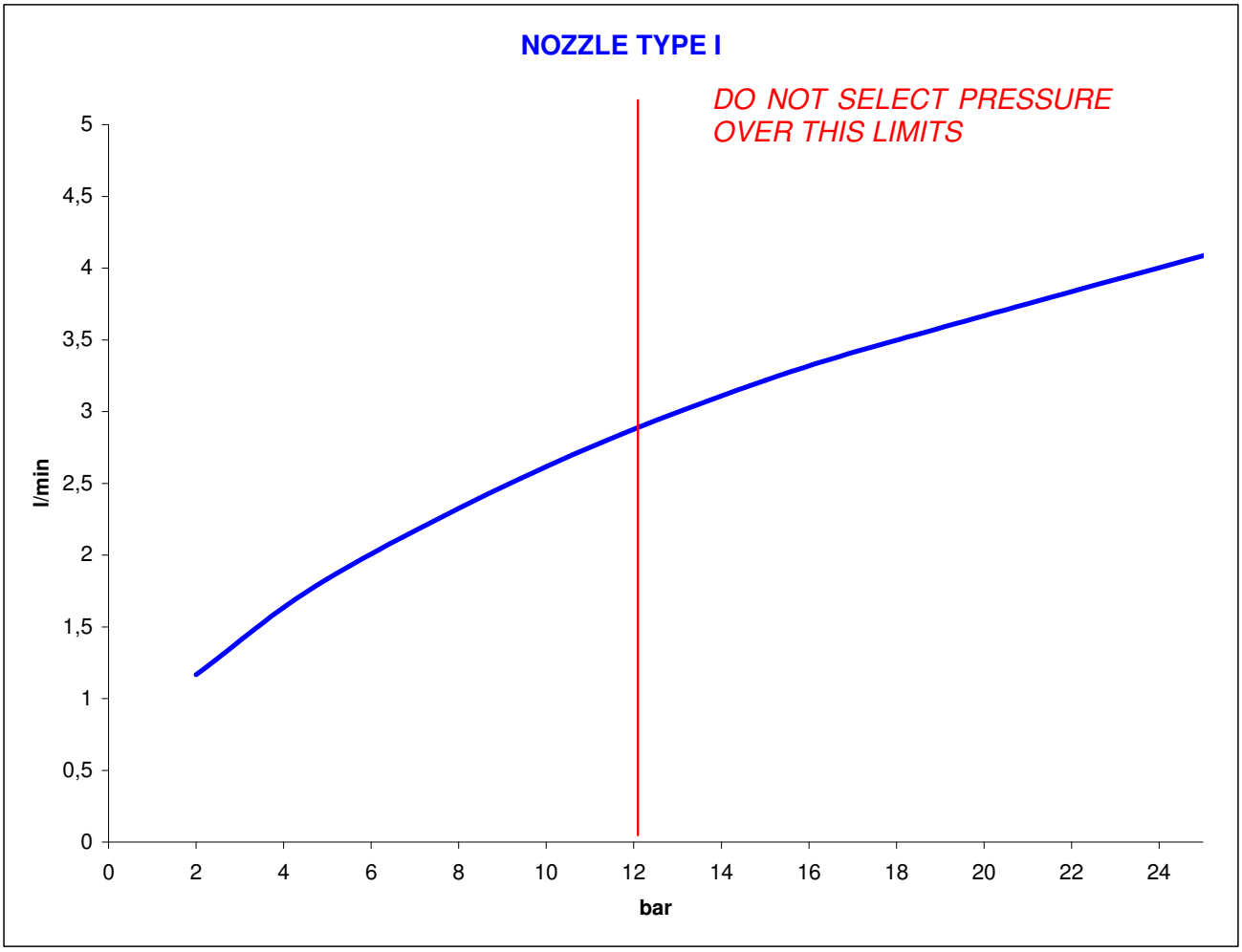
Electrical wiring D: Every nozzle is designed to work at 2.5bar and nebulize 0.3 l/min.
Electrical wiring Y: Every nozzle is designed to work at 1.5bar and nebulize 0.15 l/min.

SETTING PRESSURE AND WATER FLOW RATE IN CASE OF SPECIAL ENVIRONMENTAL CONDITION

In this section there are three graphs, each one show a pressure-flow correlation.
To set the Spray Water Device, if environmental condition is over the functionality range, use the graph below. Use this graph type also when suggested in troubleshooting section.

Example: if the line water pressure is higher than 2.5÷3.0, the flow rate will be higher.
Thanks to these graphs it' possible to predict Device efficiency.

Nozzle Type I pressure-flow selection chart

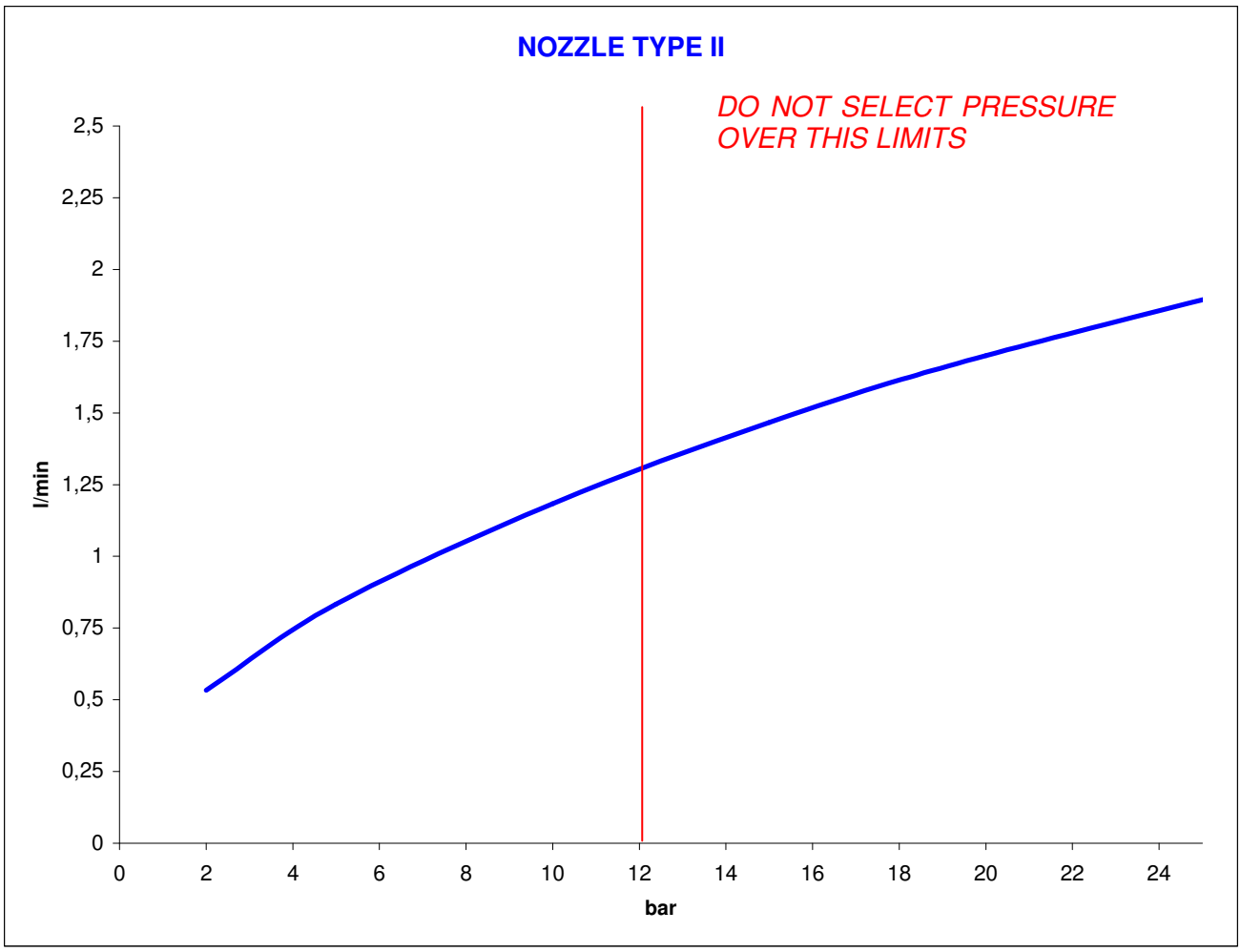


This type of nozzle is mounted on:*

- VDDS 800-910
- VDDL 800-910

It assure an optimal air saturation with high airflow rate.
A large water spray cone allow to cover all the coil surface, especially where the air velocity is maximum.

Nozzle Type II pressure-flow selection chart



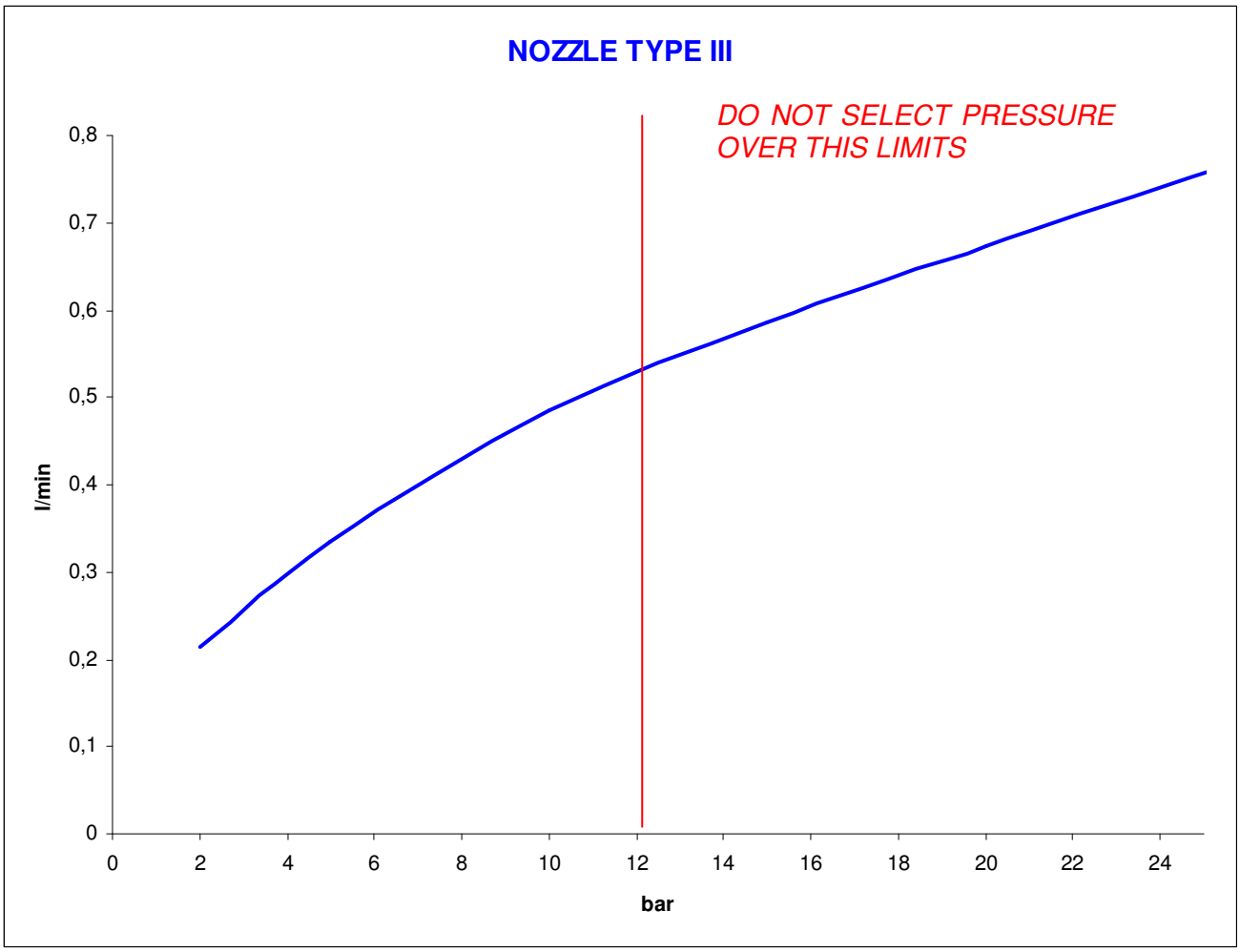
This type of nozzle is mounted on:*

- VDDQ 800-910-1000
- VDDR 800-910-1000
- BCDT BCDS BDDT BDDS BNDT BNDS 800-910
- BCDL BDDL BNDL 800-910

It assure an optimal air saturation with lower airflow rate than previous model.

It's suggested to use this type of nozzle on and VDDL 800 and VDDL 910 if the design temperature is lower than 25°C and/or the relative humidity is higher than 60%.
In this way it's possible to avoid the flooding risk, that could be effective in the upon weather conditions.

NozzleType III pressure-flow selection chart



This type of nozzle is mounted on:*

- DCDQ BCDQ BDDQ BNDQ 800-910-1000
- DCDR BCDR BDDR BNDR 800-910-1000

It's used to guarantee the best humidification efficiency, also with low airflow rate.

*on version with electrical wiring D

Note

Never set device to work over 12 bar.

Note

All types of nozzle can be fitted in the whole units range.
See Spare Parts section to know Alfa Laval code of nozzle Type I, Type II and Type III.

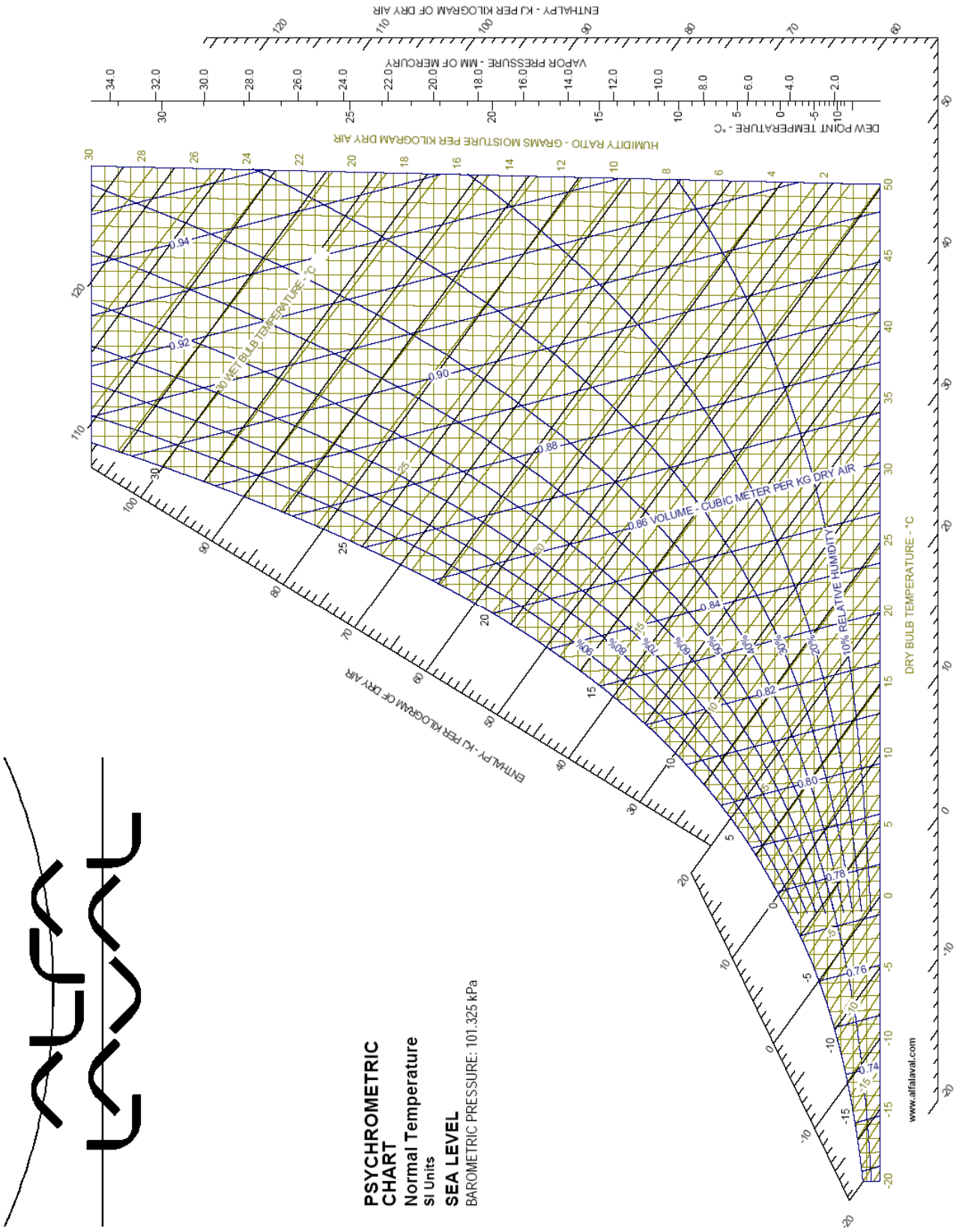
Below a table to find a water density at design temperature and relative humidity.
Use these table to perform a calculation of water needed in case of abnormal weather conditions.

Temp ℃	U.R. %	Dens Kg/m³	Temp ℃	U.R. %	Dens Kg/m³	Temp ℃	U.R. %	Dens Kg/m³
20	30	1,2	29	30	1,16	38	30	1,13
20	40	1,2	29	40	1,16	38	40	1,12
20	50	1,2	29	50	1,16	38	50	1,12
20	60	1,2	29	60	1,16	38	60	1,12
21	30	1,2	30	30	1,16	39	30	1,12
21	40	1,2	30	40	1,16	39	40	1,12
21	50	1,19	30	50	1,15	39	50	1,12
21	60	1,19	30	60	1,15	39	60	1,11
22	30	1,19	31	30	1,15	40	30	1,12
22	40	1,19	31	40	1,15	40	40	1,11
22	50	1,19	31	50	1,15	40	50	1,11
22	60	1,19	31	60	1,15	40	60	1,11
23	30	1,19	32	30	1,15	41	30	1,11
23	40	1,19	32	40	1,15	41	40	1,11
23	50	1,19	32	50	1,15	41	50	1,11
23	60	1,18	32	60	1,14	41	60	1,1
24	30	1,18	33	30	1,15	42	30	1,11
24	40	1,18	33	40	1,14	42	40	1,11
24	50	1,18	33	50	1,14	42	50	1,1
24	60	1,18	33	60	1,14	42	60	1,1
25	30	1,18	34	30	1,14	43	30	1,11
25	40	1,18	34	40	1,14	43	40	1,1
25	50	1,18	34	50	1,14	43	50	1,1
25	60	1,18	34	60	1,14	43	60	1,09
26	30	1,18	35	30	1,14	44	30	1,1
26	40	1,17	35	40	1,14	44	40	1,1
26	50	1,17	35	50	1,13	44	50	1,09
26	60	1,17	35	60	1,13	44	60	1,09
27	30	1,17	36	30	1,13	45	30	1,1
27	40	1,17	36	40	1,13	45	40	1,09
27	50	1,17	36	50	1,13	45	50	1,09
27	60	1,17	36	60	1,13	45	60	1,09
28	30	1,17	37	30	1,13			
28	40	1,17	37	40	1,13			
28	50	1,16	37	50	1,12			
28	60	1,16	37	60	1,12			

ATTENTION!

Always check pressure and flow conditions, arranging it in case of environment conditions change. Also see troubleshooting section.

Below a psychrometric chart.
Use these table to perform a calculation of water needed in case of abnormal weather conditions.



QUALITY OF WATER

On this kit use only water characterized by:

PH: 6 ÷ 7
Hardness: 8 ÷ 12 °F (80 ÷ 120 ppm as $CaCO_3$)

Using this kind of water, after 400 hours of use, there will not visible limestone deposit and calcium layer on the coil.

Anyhow tube is made of Inox to avoid internal rust formations, also during the inactivity time.
Pipe is developed to be easy drainable, it's possible to inclin from bends to collectors side.
Anyhow, assure to flux with air the pipeline during non operative time, to avoid freezing risk.

NOTE

If the utilization exceed 400 hours per year apply an suitable coil treatment (depending also on surrounding conditions)

ATTENTION!

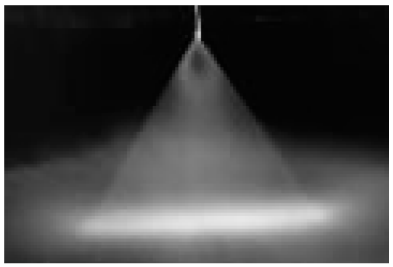
Always use a filter on pipeline to avoid deposit of dirt.

Flux the pipeline with air to complitely drain the water during inactivity period.

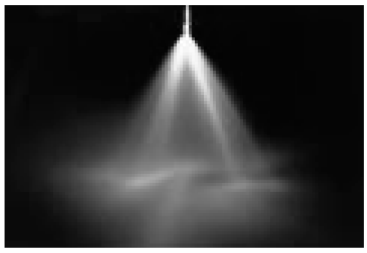
SERVICE INSTRUCTIONS

ATTENTION!
Before starting service operations make sure that the circuit is reliably switched off!
Trouble-free operation of Spray Water Device adiabatic system requires regular service to check.

NOZZLE MAINTENANCE
The nozzles need regular maintenance with the scope of keeping the efficiency and avoid damages. A first check after 5 hours of running and then every 100 hours is suggested.



Spray from clean nozzle



Distorted spray from damaged or clogged nozzle

Common causes of spray nozzle problems:

- **Erosion.** The gradual removal of material from the surfaces of the nozzle orifice and internal flow passages causes them to become larger and/or distorted, which can affect flow, pressure, and spray pattern.
- **Clogging.** Unwanted dirt or other contaminants blocking the inside of the orifice can restrict the flow and disturb spray pattern uniformity.
- **Caking.** Over spraying, misting, or chemical buildup of material on the inside or outer edges of the orifice from evaporation of liquid can leave a layer of dried solids and obstruct the orifice or internal flow passages.
- **Temperature damage.** Heat may have an adverse effect on nozzle materials not intended for high-temperature applications.
- **Improper reassembly.** Misaligned gaskets or other repositioning problems can result in leakage as well as poor spray performance.
- **Accidental damage.** Scratching through the use of improper tools during installation or cleaning can cause inadvertent harm to an orifice.

Erosion and wear | Caked | Corroded | Heat damaged | Damaged

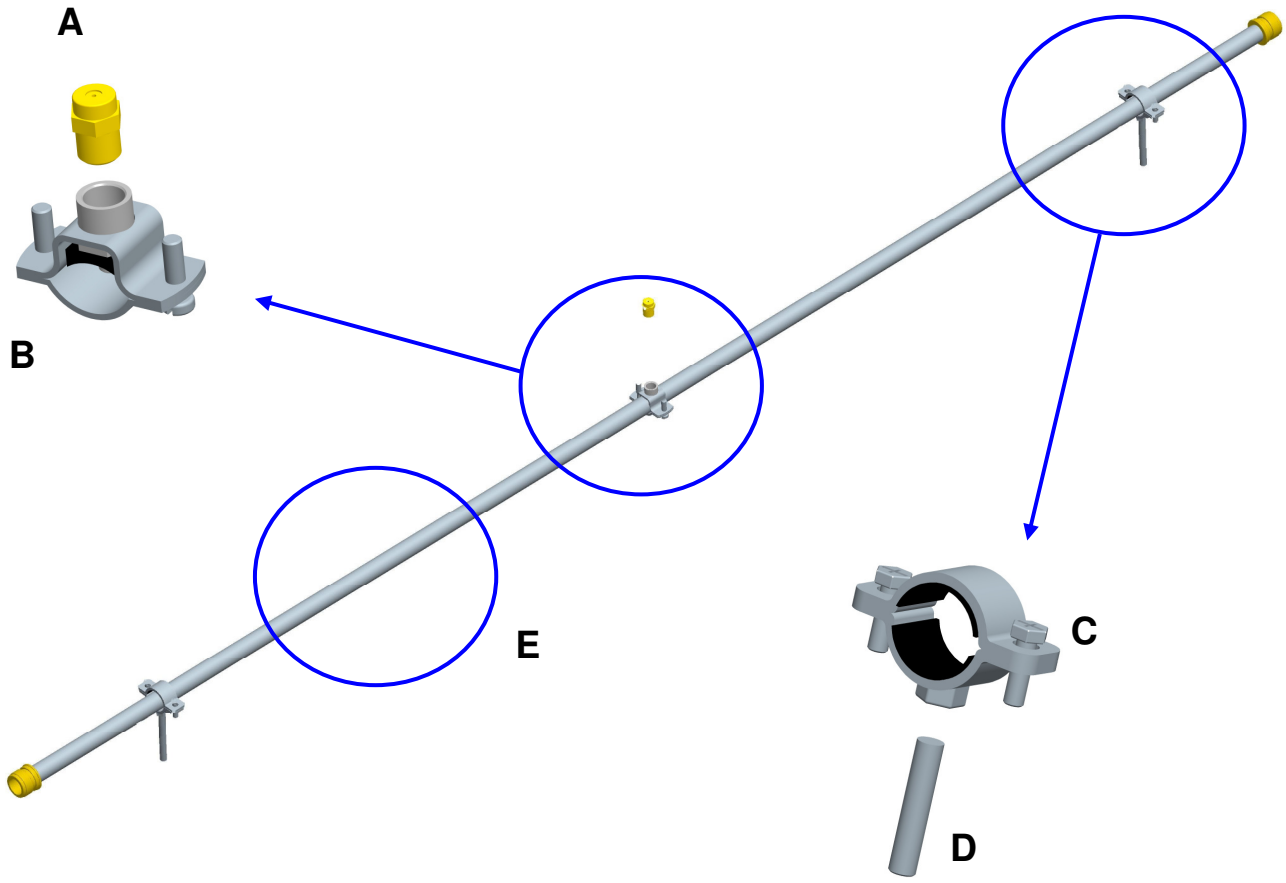
PIPELINE MAINTENANCE
Verify that the circuit is not occluded, it can happen if the quality of water is not as requested before. A first check after 10 hours of running and then every 200 hours is suggested.

DRAINAGE TO AVOID ICE FORMATIONS
If the ambient temperature is under zero remember to drain the pipeline, to avoid the formation of ice.

CLEANLINESS OF COIL
Follow the instruction manual of unit to clean the coil (clean at least two time per year to keep out the limestone).

SPARE PARTS

(for details see the RCPL)



ATTENTION!
Use only Alfa Laval original spares

A Nozzle	See pages 18-20	**Type I** **Cod.** 41002561	**Type II** **Cod.** 41002560	**Type III** **Cod.** 41002559
B Split Eyeless Connectors	All Units		**Cod.** 41002558	
C Pipe Supporting Ring	All Units		**Cod.** 43007550	
D Rod	All Units		**Cod.** 43007551	

E Pipeline	DCV_802_902_1002	**Cod.** V9999883+		
	DCV_803_903_1003	**Cod.** V9999882+		
	DCV_804_904_1004	**Cod.** V9999883+	**Cod.** V9999879	
	DCV_805_905_1005	**Cod.** V9999882+	**Cod.** V9999879	
	DCV_806_906_1006	**Cod.** V9999882+	**Cod.** V9999878	
	DCV_807_907_1007	**Cod.** V9999882+	**Cod.** V9999879	
	DCV_808_908_1008	**Cod.** V9999883+	**Cod.** V9999878	
	DUAL_802	**Cod.** V9999897+		
	DUAL_803	**Cod.** V9999896+		
	DUAL_804	**Cod.** V9999897+	**Cod.** V9999895	
	DUAL_805	**Cod.** V9999896+	**Cod.** V9999895	
	DUAL_806	**Cod.** V9999896+	**Cod.** V9999894	
	DUAL_902_1002	**Cod.** V9999893+		
	DUAL_903_1003	**Cod.** V9999893+	**Cod.** V9999892	
	DUAL_904_1004	**Cod.** V9999893+	**Cod.** V9999891	
	DUAL_905_1005	**Cod.** V9999893+	**Cod.** V9999891+	**Cod.** V9999892

Below a list of pipe code with relative length.
Every pipe is provided with rapid connections for fast and easy mounting.

Code	**V9999878**	**V9999879**	**V9999882**	**V9999883**	**V9999884**	**V9999885**
Length	3895 mm	2585 mm	4080 mm	2770 mm	4165 mm	2065 mm
Code	**V9999886**	**V9999887**	**V9999888**	**V9999889**	**V9999890**	**V9999891**
Length	4450 mm	5215 mm	3465 mm	5500 mm	3750 mm	4165 mm
Code	**V9999892**	**V9999893**	**V9999894**	**V9999895**	**V9999896**	**V9999897**
Length	2065 mm	4450 mm	5215 mm	3465 mm	5500 mm	3750 mm

TROUBLESHOOTING

Problem	Possible Cause	Solution
No water from nozzles	No water inlet	Check the connection
No water from one nozzle	Dirt on pipe section or nozzle	Check pipe or nozzle
Water dripping	Environmental conditions are changed	Decrease the pressure according with new calculated water flow rate.
	Wrong water pressure or flow rate	Check water pressure and flow rate

NOTE

Rev. 03: Added model AlfaBlue Condenser - AlfaBlue Dry Cooler – AlfaBlue Ammonia Condenser

Rev. 04: Delete old series, DCD – ACD – DCV. Sobstitute cod.43007520 with 43007550 and cod.43007524 with 43007551 both in stainless steel material.
Sobstitute the Palladio selection with CAS selection.

Rev.05: Delete the E (Pipe Supporting Stirrup) component cod. 60626118.

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